PA Statewide Conference on Abandoned Mine Reclamation

Friday, August 25, 2006

FLOODPLAIN RESTORATION

Mark Gutshall / Jon Klotz

LandStudies

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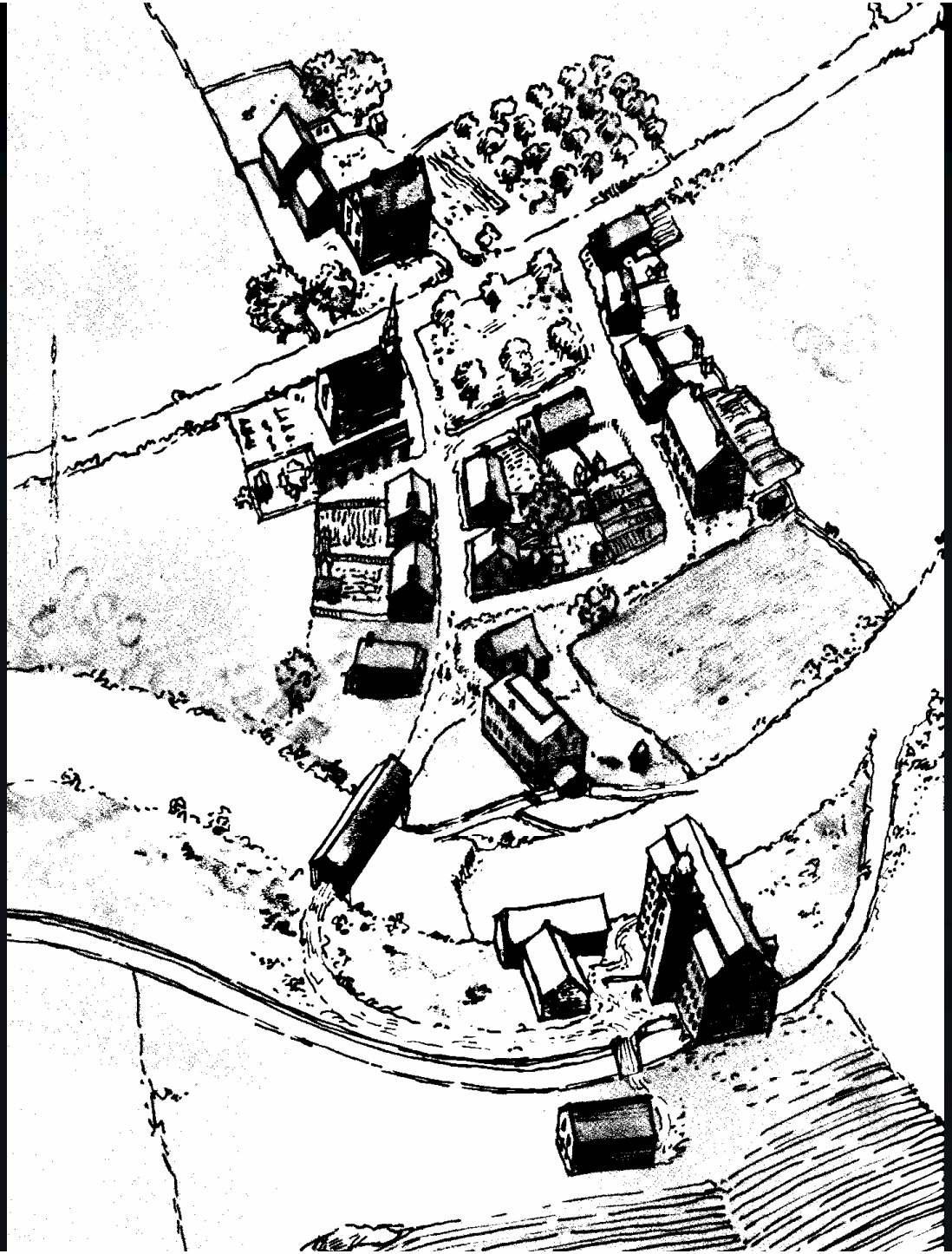
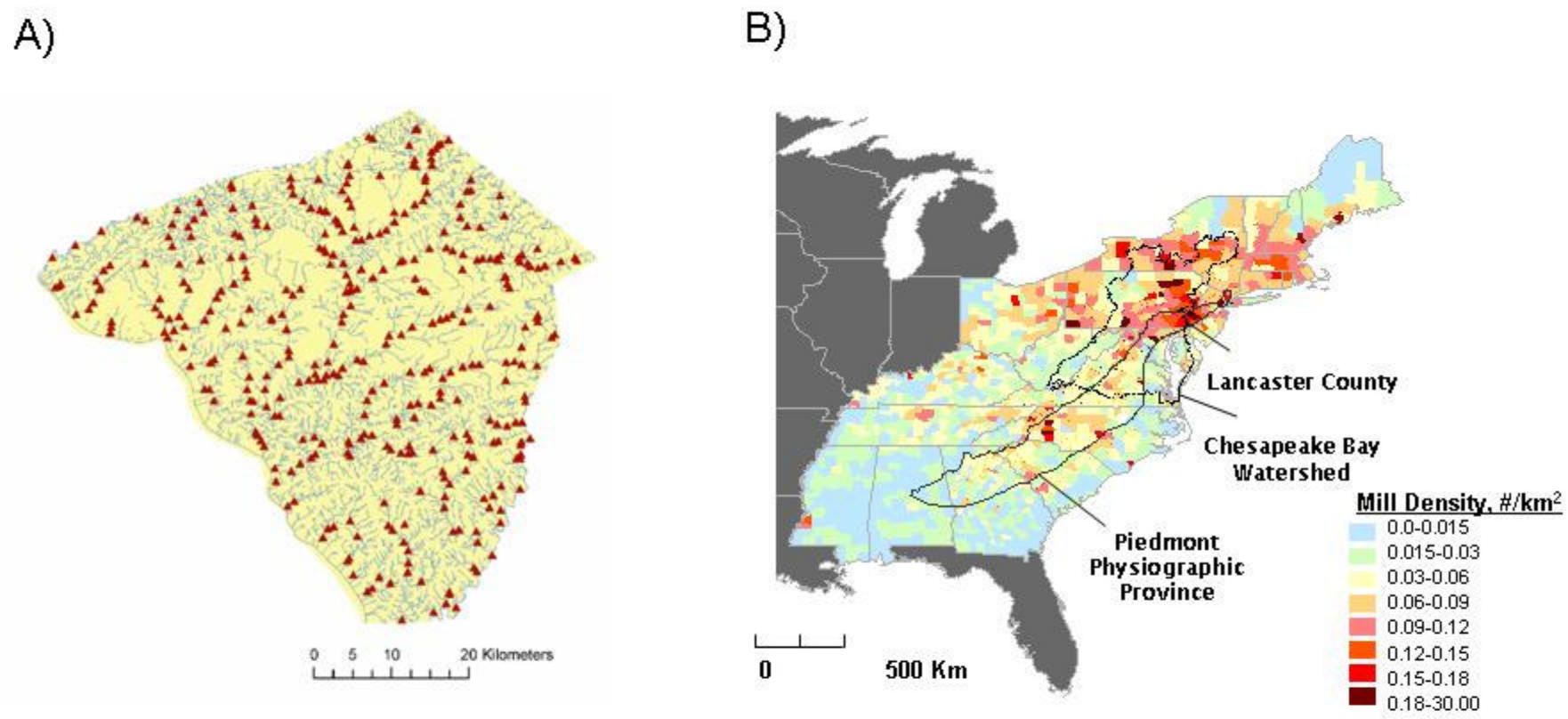
Land clearing allowed sediment to wash into valleys

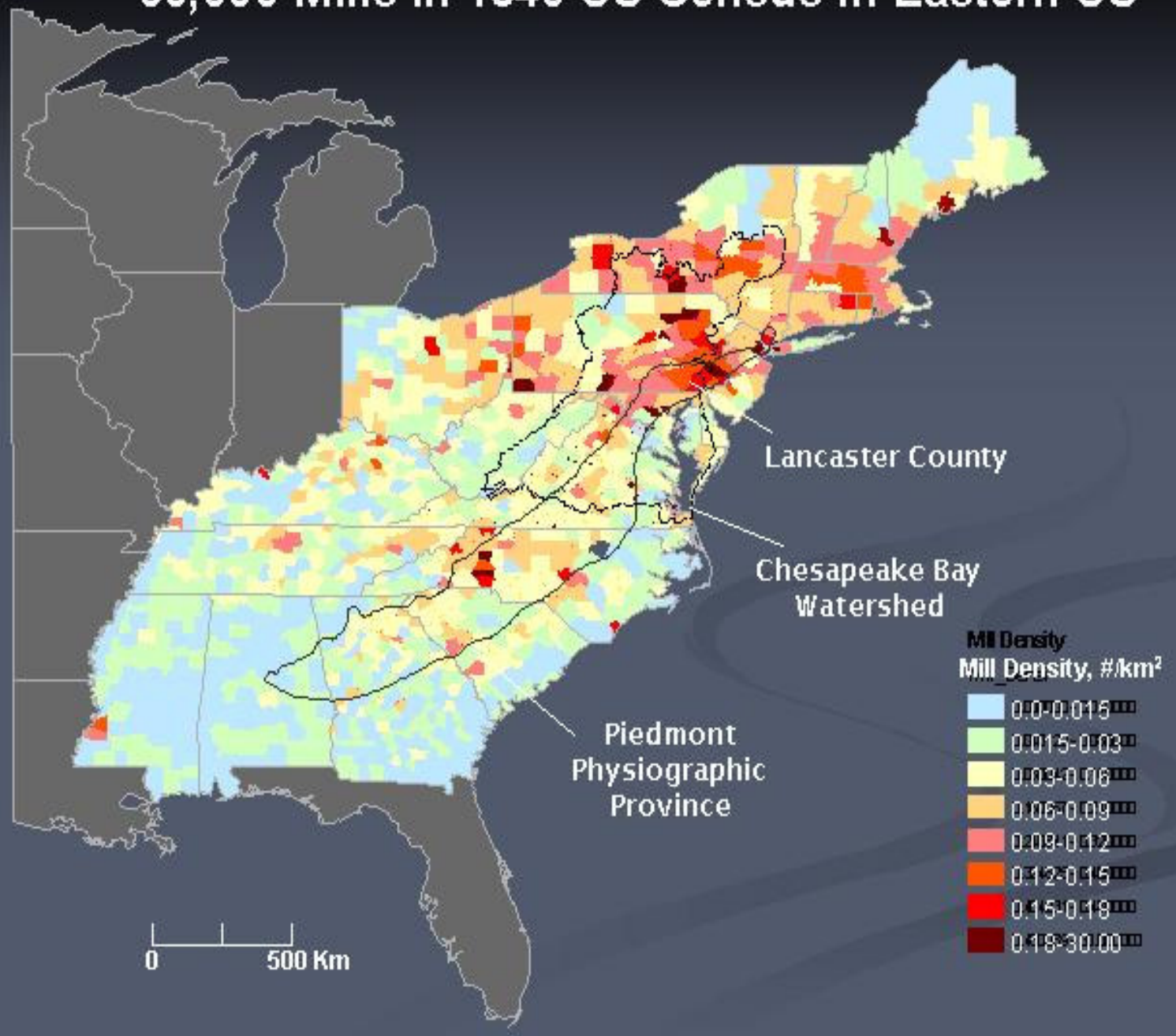


An Historic Legacy of Mill Dams in the Mid-Atlantic



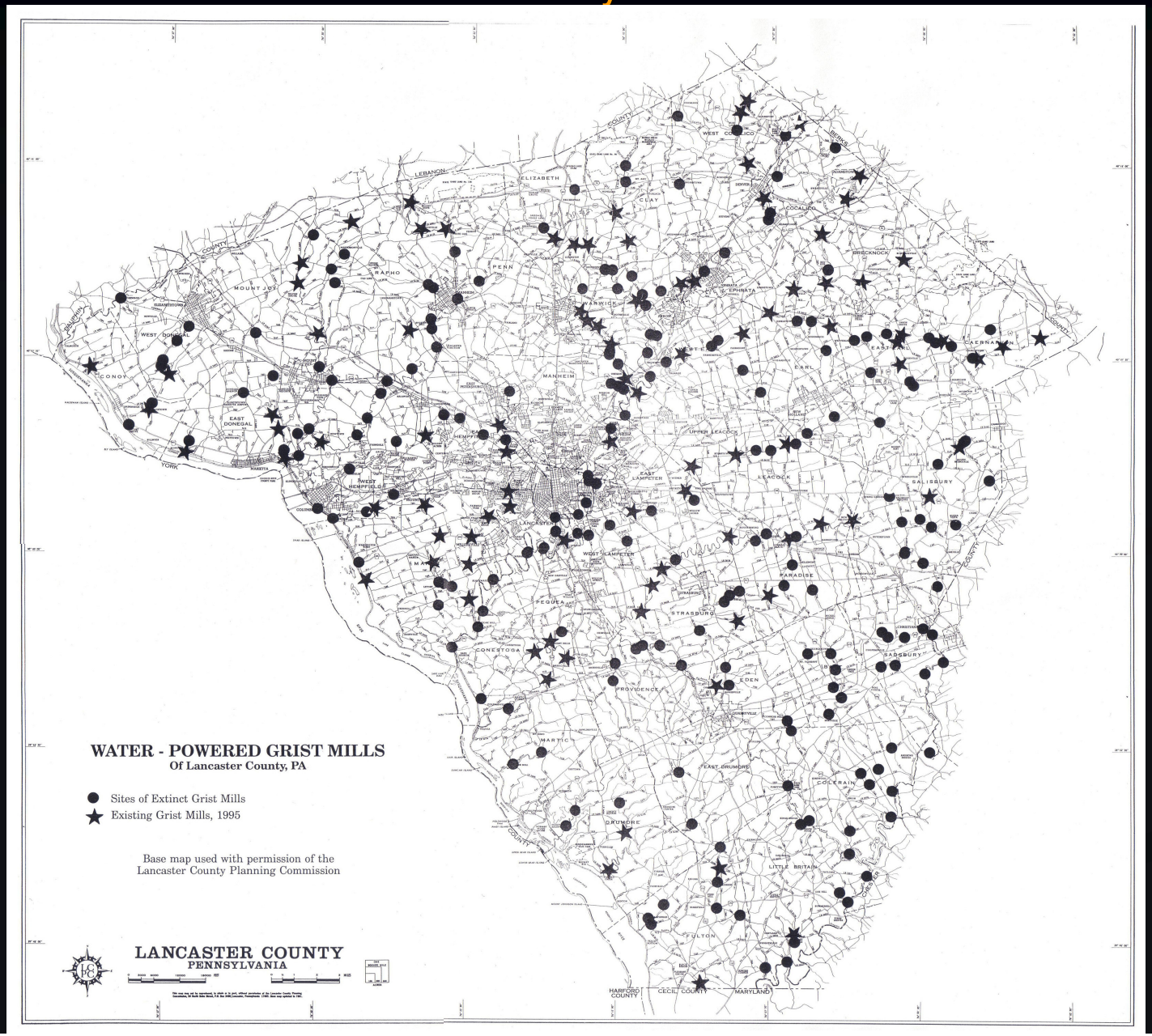
At least 383 mill dams were located in Lancaster County by the mid-1800s (left), which converted streams to a series of linked slackwater ponds. Approximately 60,000 mill dams existed in the Chesapeake Bay watershed by 1840 (right); all drew water from slackwater ponds behind mill dams. Figure credit: Franklin & Marshall College, Lancaster, PA.

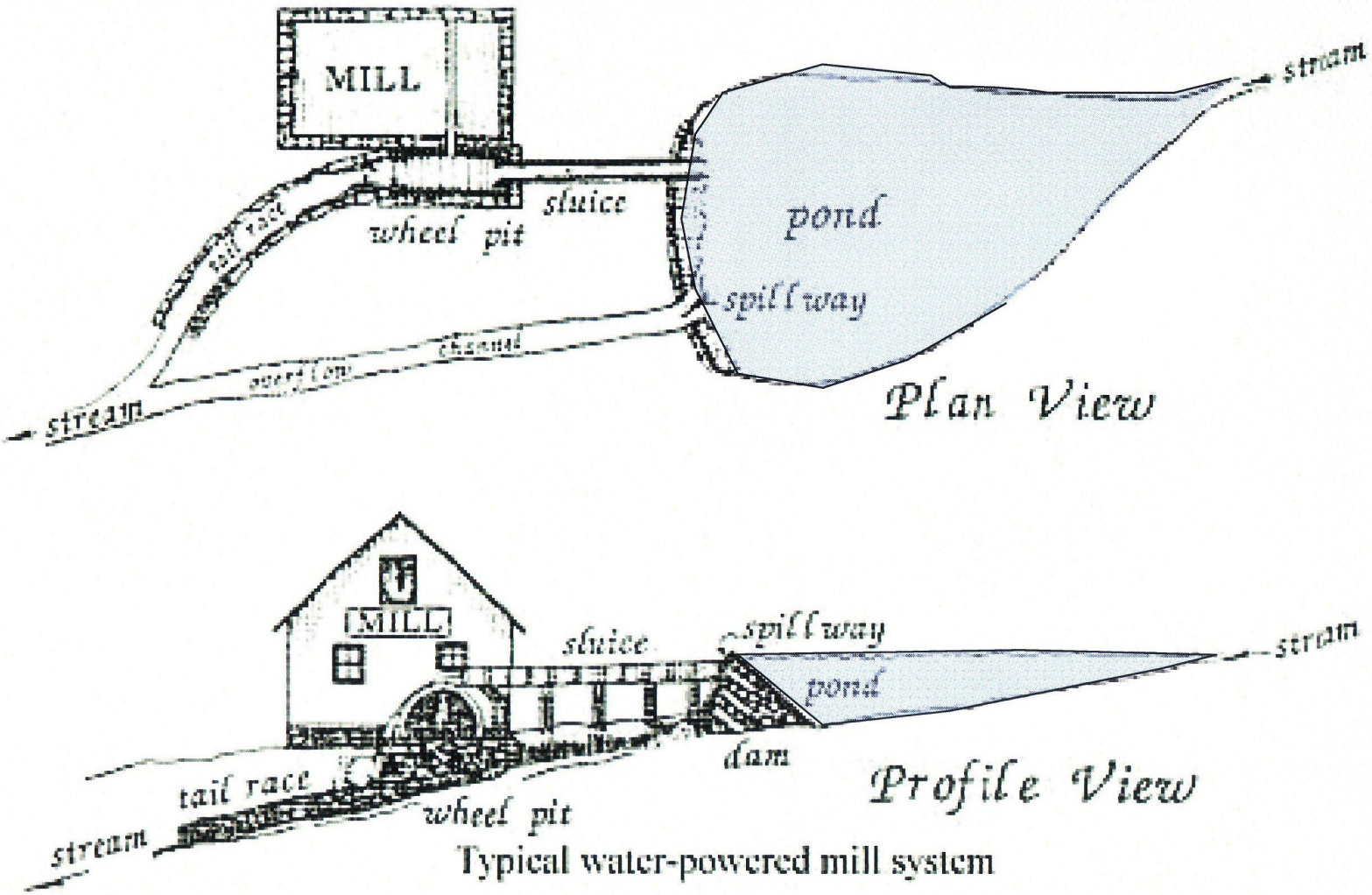
~60,000 Mills in 1840 US Census in Eastern US



Sediment trapped behind mill dams

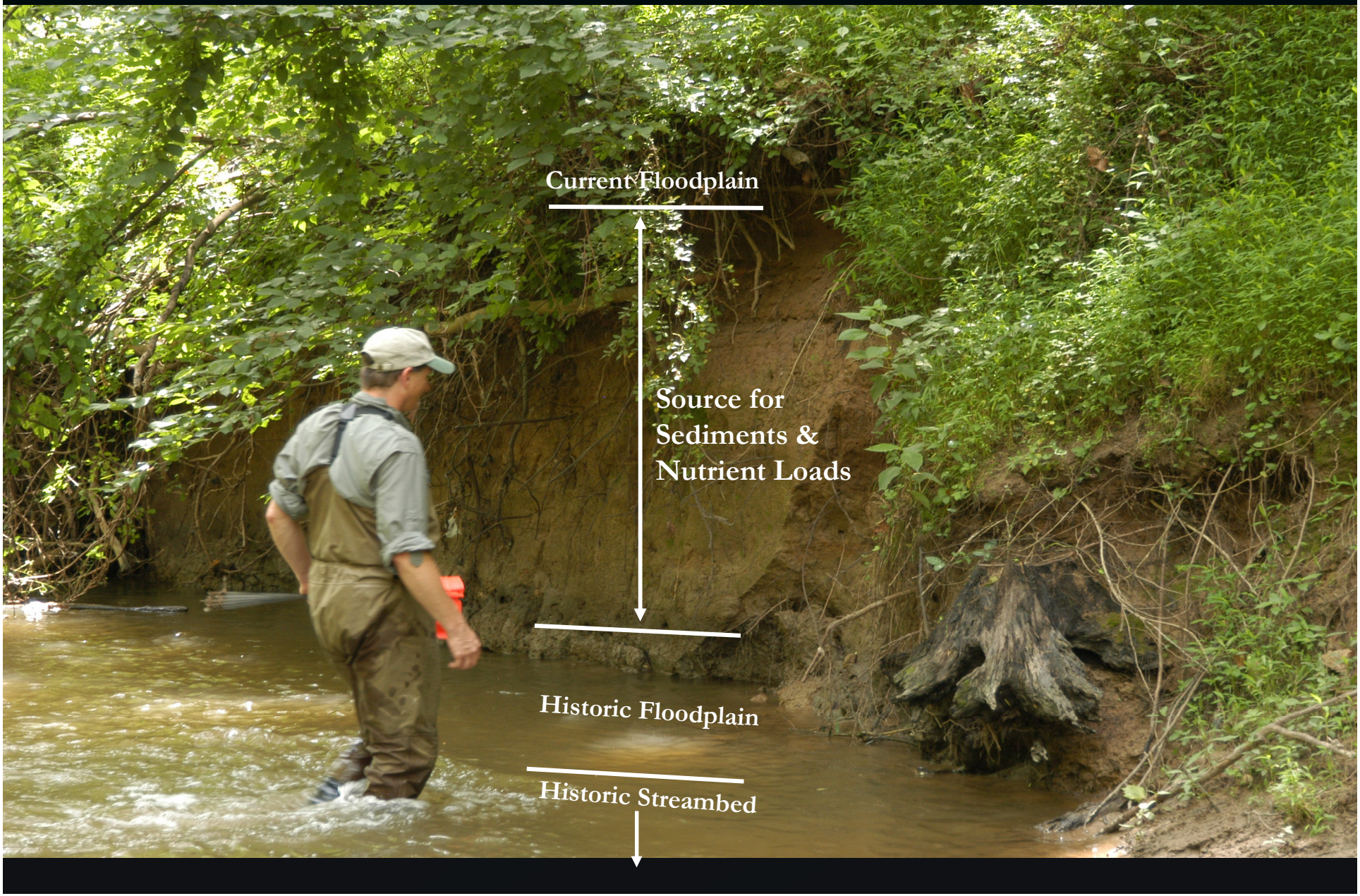
Lancaster County Grist Mills





Typical water-powered mill system

Post-Settlement Sedimentation



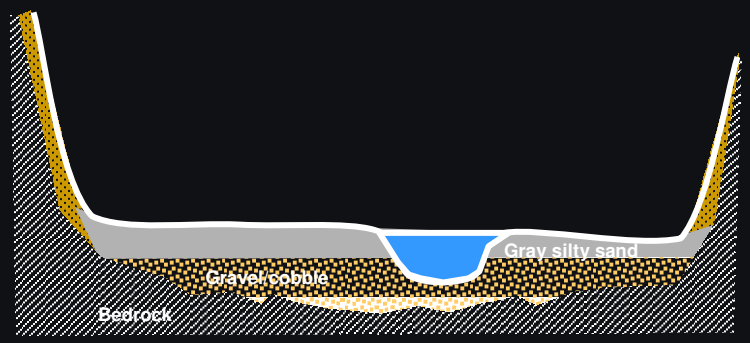
Indicator of High Sedimentation

Pre-Settlement

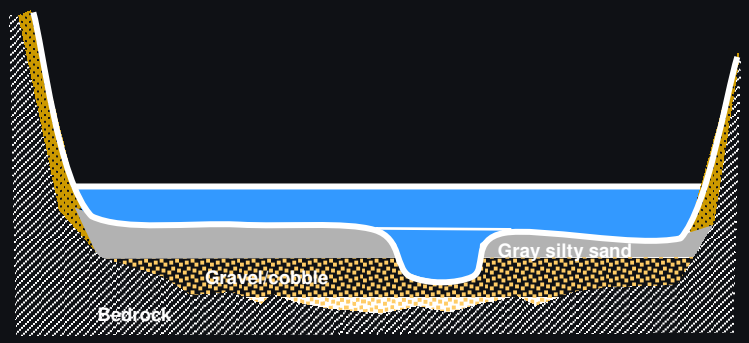
Natural Stream Location

Stable Stream and Floodplain Conditions

Frequent Flows



Larger Floods

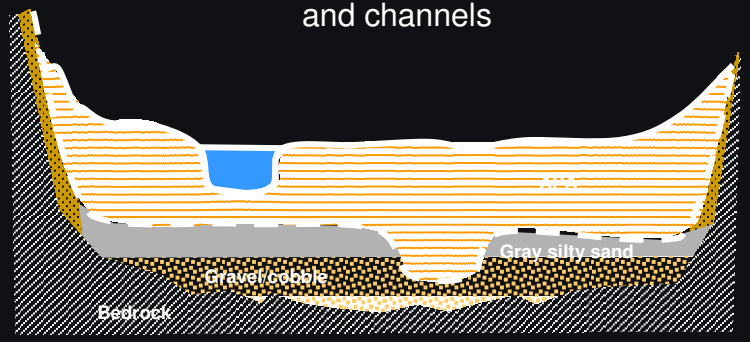


Post-Settlement

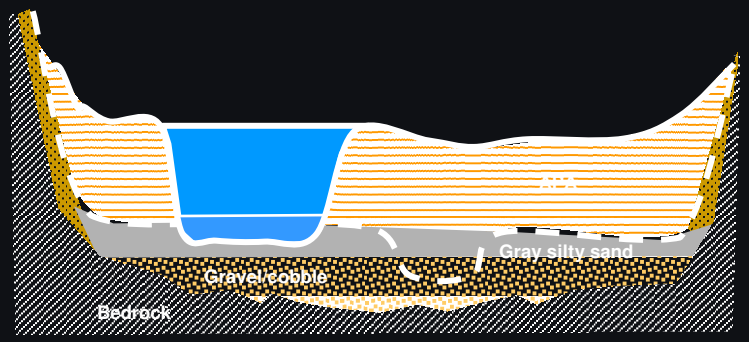
Unstable Stream Location

Unstable Stream Location:
rapid sedimentation and rapid down cutting

Erosion of hillside soils produced from early agricultural practices "buried" pre-settlement floodplains and channels



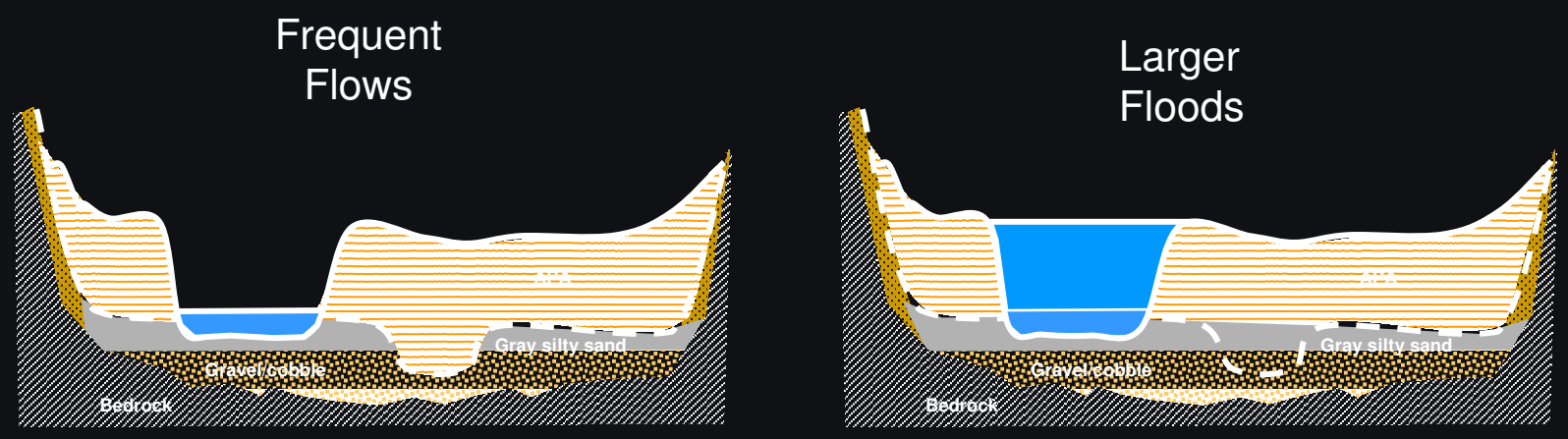
Channel straightening and enlargement enhanced the rapid incision and widening



Post-Settlement

Stream is narrow and deep

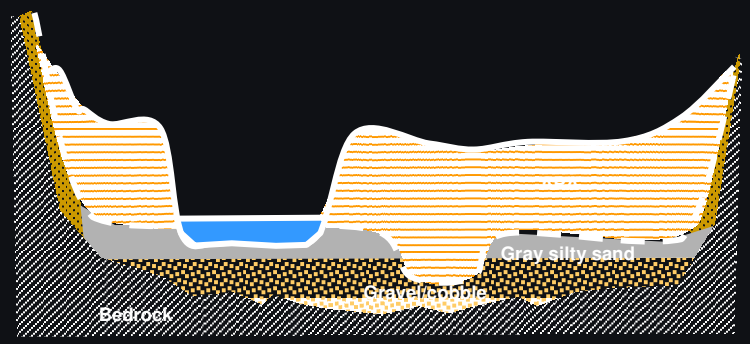
Stream Banks Erode During Normal and High Flows



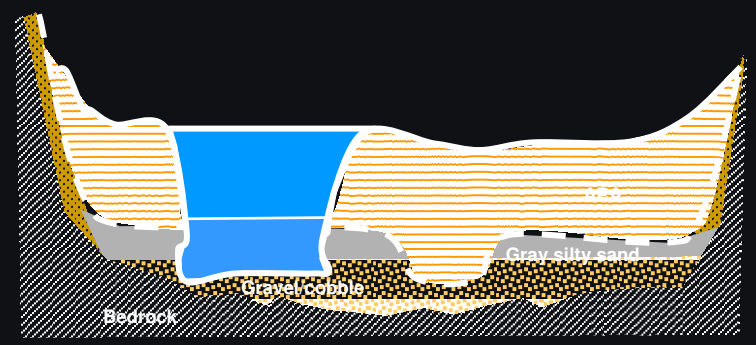
Post-Settlement

Stream shape and location changes from unstable to stable

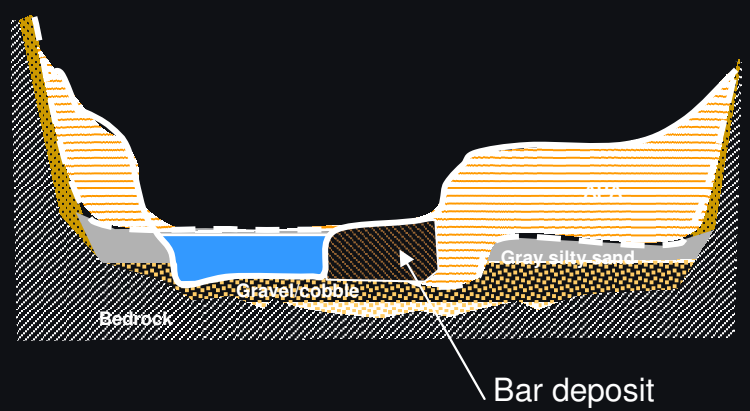
Channel “perched” on gray cohesive silty sand



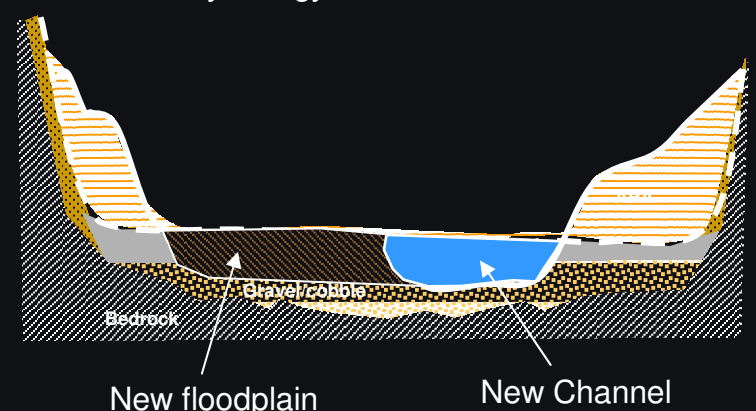
Channel cuts through gray cohesive silty sand



Banks undermined, trees topple, channel widens and bars form



Agricultural deposit eroded over time and new floodplain and channel formed to match modified hydrology and sediment load



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Headcut Edge Migrating Upstream

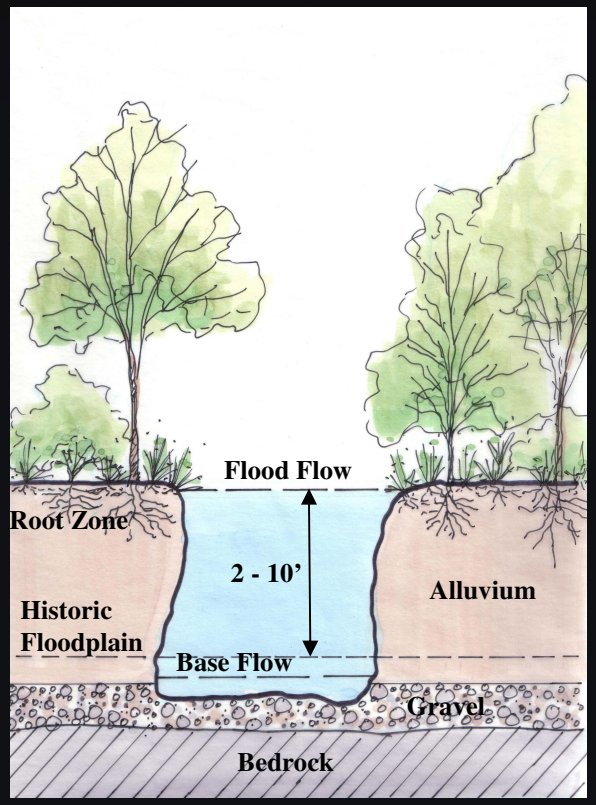
Looking upstream of headcut

Looking downstream of headcut

Crabby Creek

Channel and Floodplain Restoration

Existing Conditions



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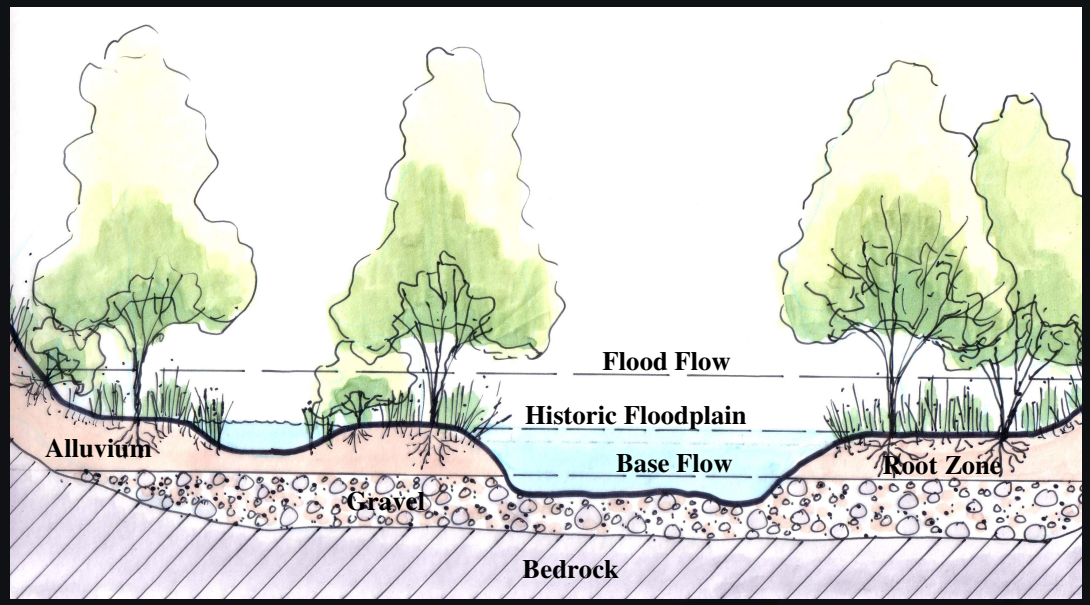
Proposed Conditions



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Channel and Floodplain Restoration

Improves In-Stream Conditions

- Improves water quality
- Encourages/Establishes native species
- Removes/Reduces invasive species
- Reduces long-term thermal impacts
- Increases aquatic habitat functions and diversity
- Improves fish spawning areas

Channel and Floodplain Restoration

Improves Stormwater Conditions

- Reduces bank erosion.
- Decreases downstream sedimentation.
- Eliminates sources of phosphorus and nitrogen in high stream banks.
- Reduces frequency and elevations of flood flows.
- Reconnects floodplain wetlands with low-interval storm events.
- Provides greater groundwater recharge opportunities.
- Creates vegetated riparian buffers.
- Increases nitrogen removal by re-connecting root zone to base-flow level.
- Recycles post-settlement alluvium into cropland or other areas.

Alternative Solutions to Regulatory Issues

- NPDES II
- Alternatives to conventional storm water management
- Infiltration/bioswales
- Floodplain restoration
- Sediment/nutrient-pollution trading
- Mitigation services
- Environmental landscaping

Stewart Run Restoration

Before Construction

During Construction

After Construction

New Street Park – Before Construction

Floodplain Restoration – New Street Site
Santo Domingo Creek – *after restoration*

Banta - before

Banta Site –

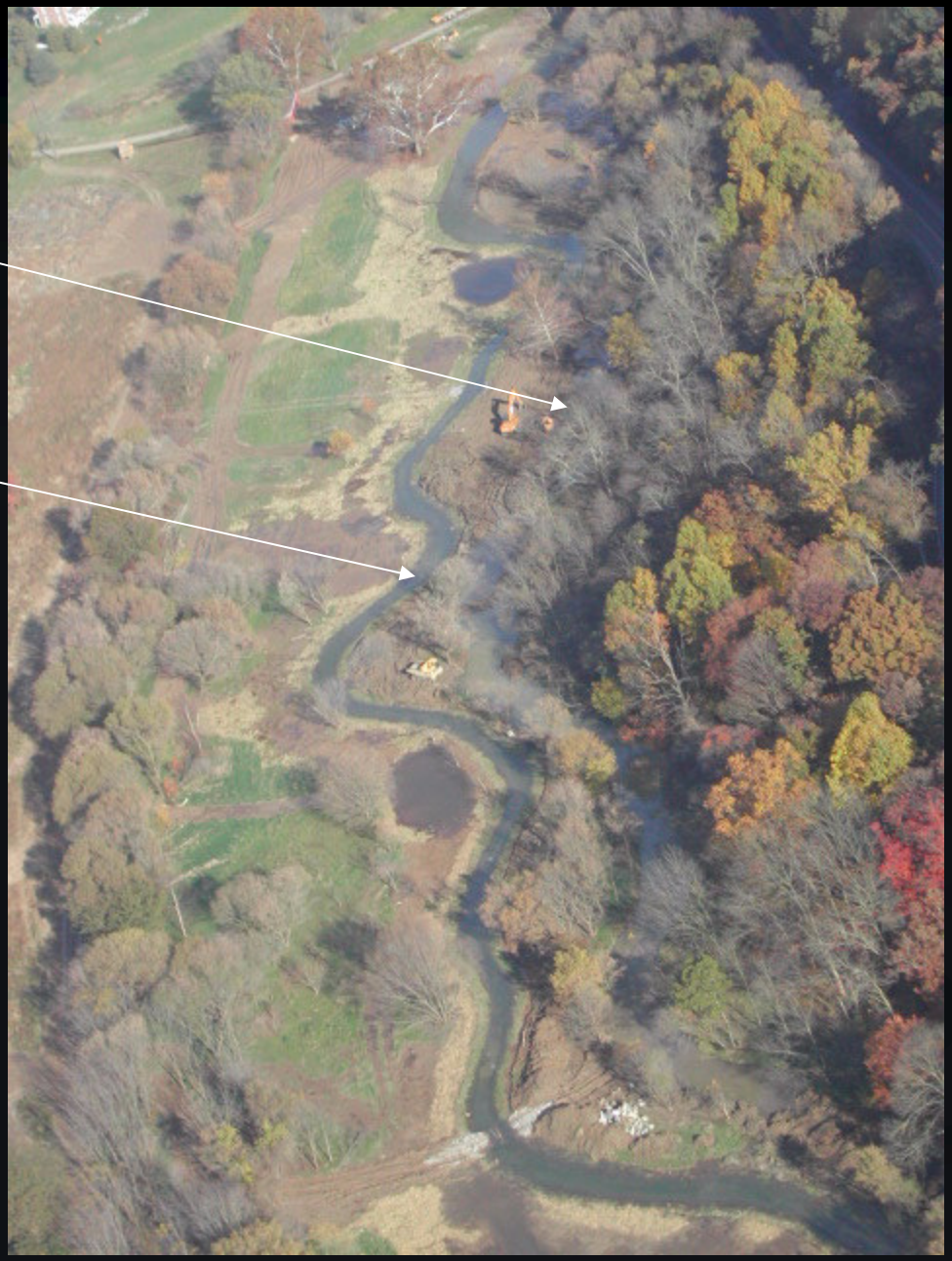
unstable **channel on left**

and *restored* channel on right

Banta Site –

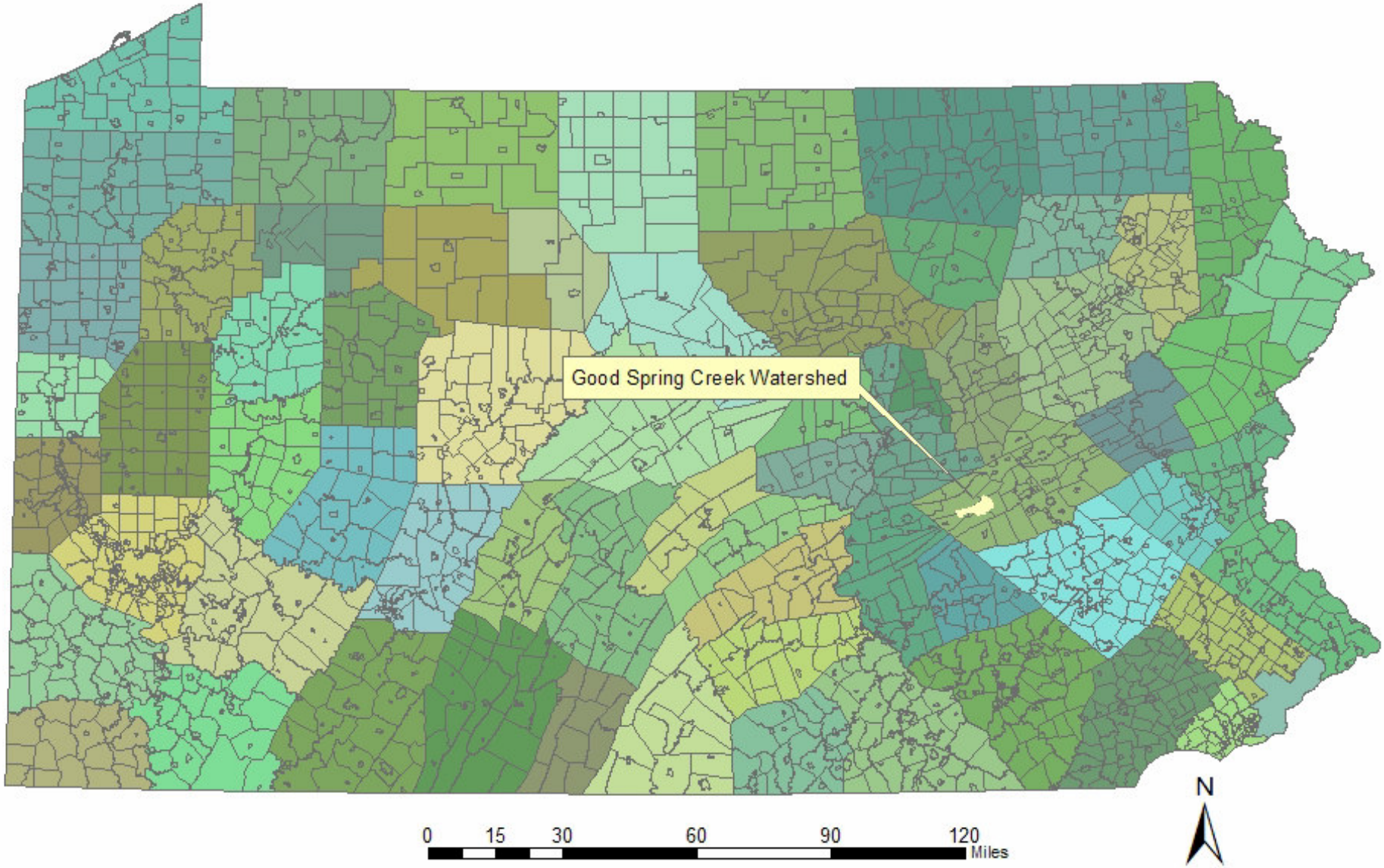
unstable **channel on right**

and *restored* channel on left



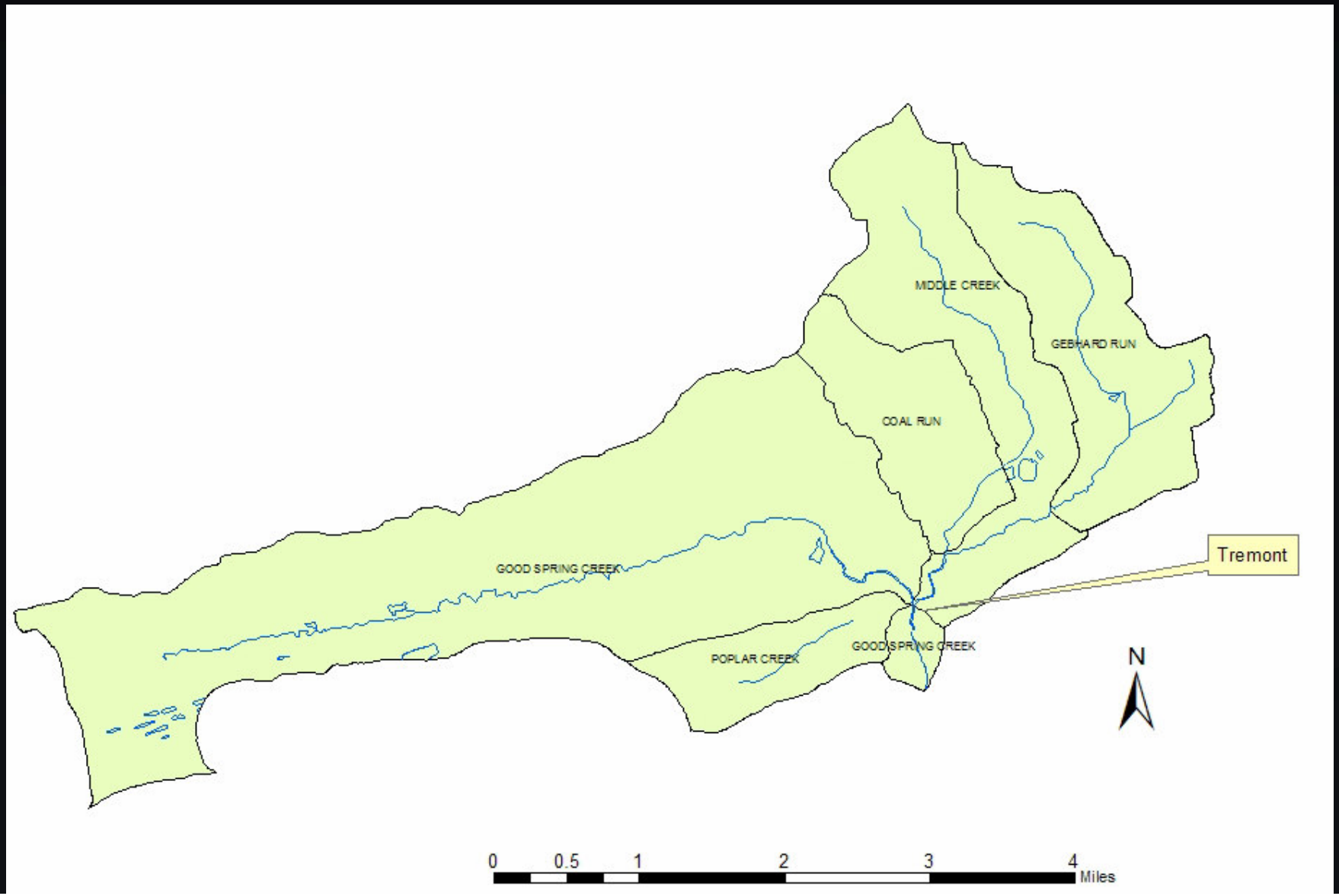
Floodplain Restoration – Banta Site
Lititz Run – *after restoration*

Good Spring Creek Watershed



Example of Assessment in an AMD Impacted Watershed

Good Spring Creek Watershed



Project Partners

- PADEP
  - Dan Koury
- Schuylkill County Conservation District
  - Tom Davidock
- U.S Geological Survey
  - Chuck Cravotta

Assessment Goals

- Determine sources of sediment that cause impacts in downstream portions of the watershed
- Evaluate overall stream channel stability throughout the watershed
- Identify priority stream reaches for restoration
- Incorporate AMD pollutant concerns with geomorphic issues
- Identify opportunities to address both AMD pollutant loading and stream channel stability/sediment loading

Prioritization

- Sediment Reduction
- Stormwater Improvement
- Water Quality
- Projects which can produce multiple benefits

Water Quality Impacts

- AMD discharge
- Sediment
- Culm piles adjacent to stream channel

Post-Settlement

Unstable Stream Location

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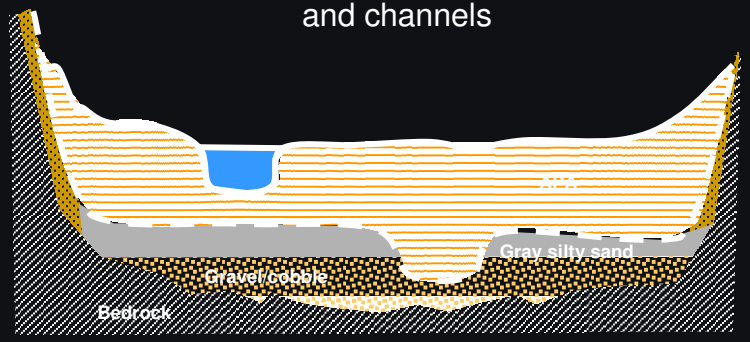

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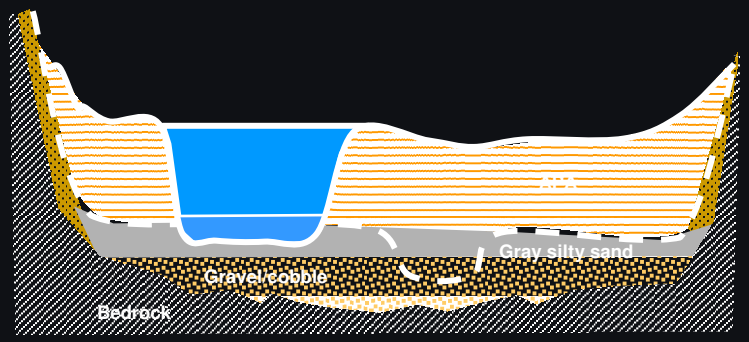

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2003 6 2

2003 5 20

2003 12 23

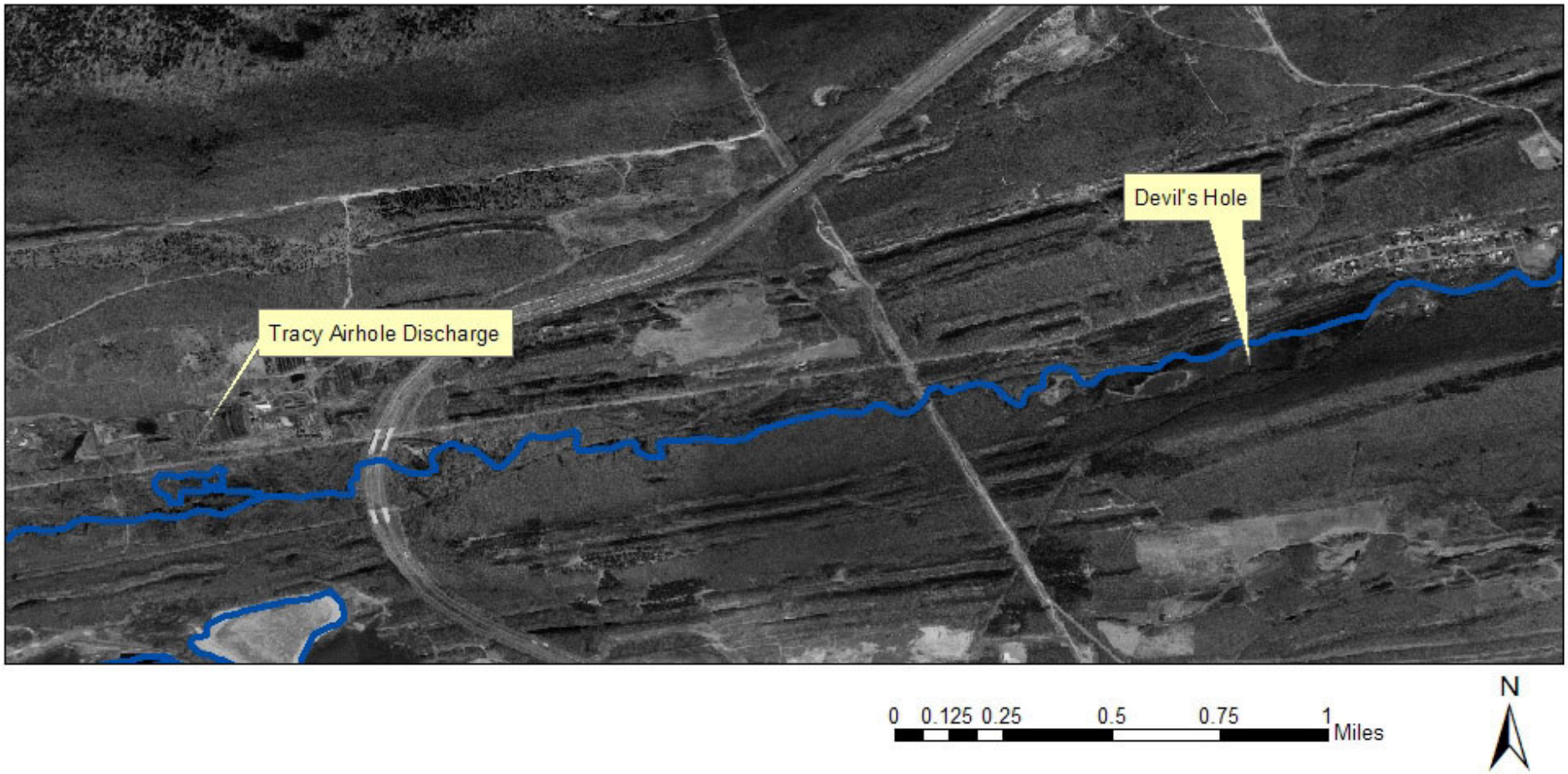
Applied Example of Floodplain Restoration in an AMD Impacted Watershed

Multiple Components

- Treatment of Mine Drainage
- Improvement of water quality
- Removal of metals already present in the system
- Downstream geomorphic stability and stormwater benefits

Treatment Approach

- Iron Removal at Tracy Airhole via settling ponds and constructed wetland
- Floodplain Restoration at Devil's Hole
  - Removal of Iron already in stream system
  - Significant reduction of sediment inputs
  - Improved floodplain storage of stormwater


Devil's Hole
Tracy Airhole Discharge
0 0.125 0.25 0.5 0.75 1 Miles
N

Tracy Airhole Discharge

- The most significant source of iron pollution in the Swatara Creek Watershed
- Average Discharge 1,200 GPM, 1.73 MGD
- Total Iron concentration 15.87 mg/L
- Average pH 6.0

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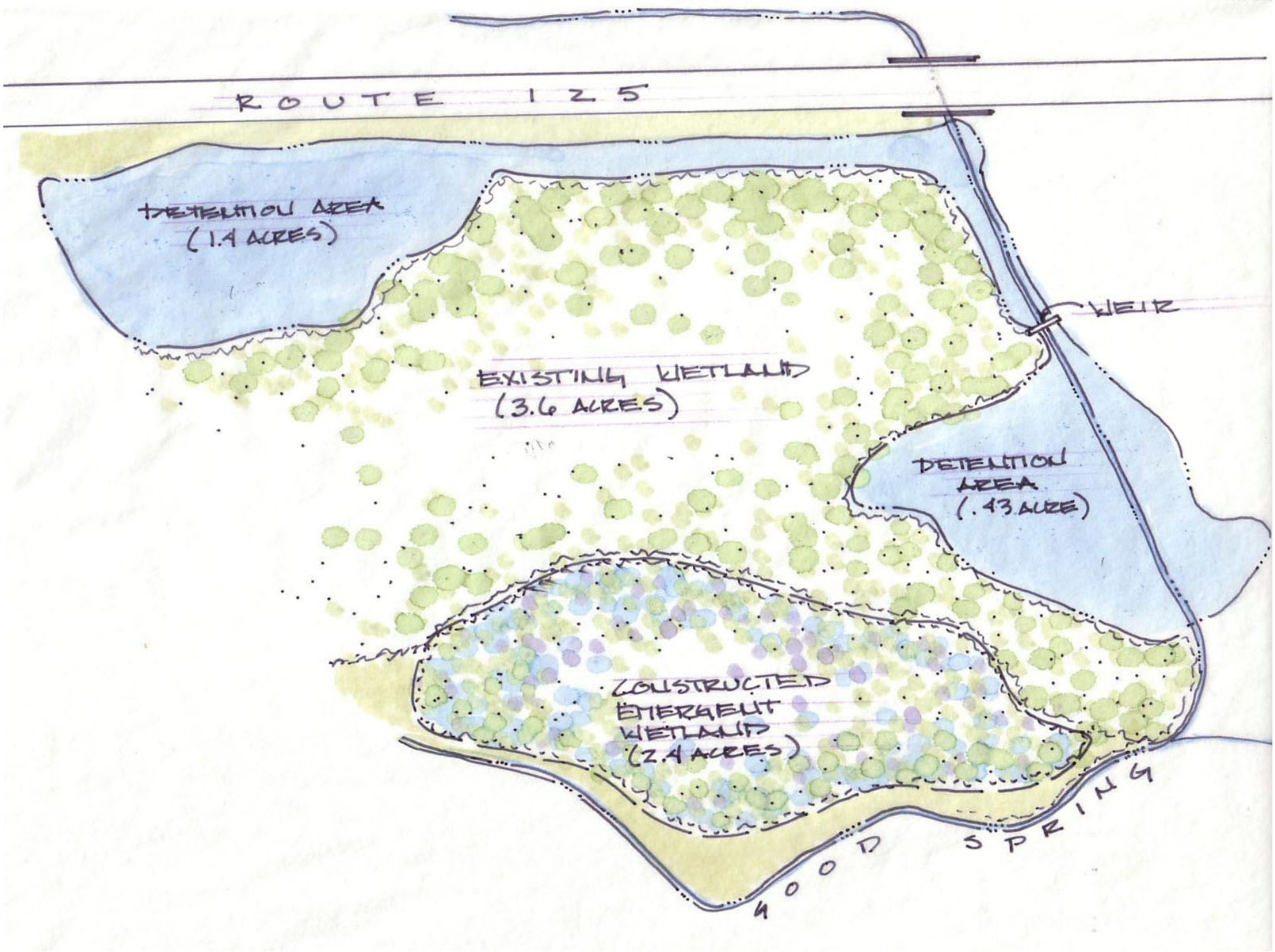
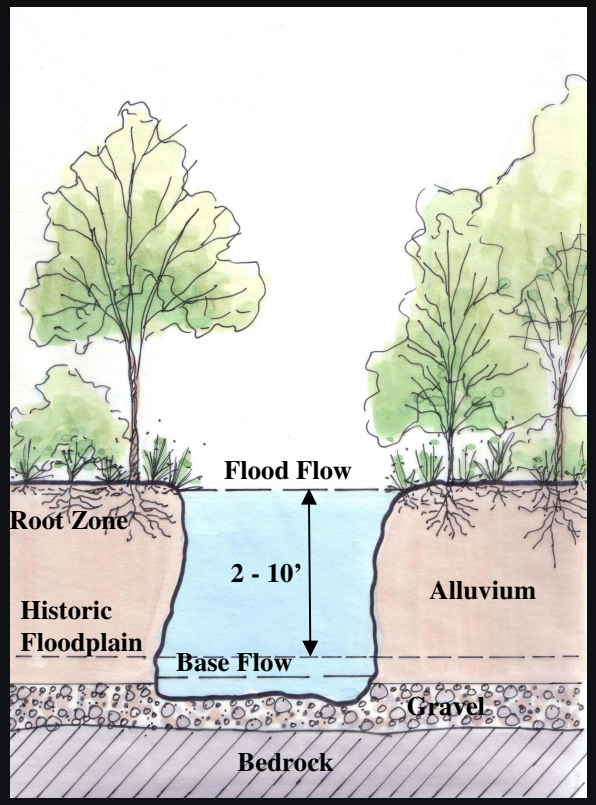

ROUTE 125
DETENTION AREA
(1.4 ACRES)
WEIR
EXISTING WETLAND
(3.6 ACRES)
DETENTION
AREA
(.43 ACRE)
CONSTRUCTED
EMERGENT
WETLAND
(2.4 ACRES)
WOOD SPRING

Devil's Hole Floodplain Restoration

- Eliminate culm pile erosion and sediment mobilization
- Improve floodplain connectivity and channel stability
- Utilize restored floodplain for removal of suspended iron already in Good Spring Creek

Channel and Floodplain Restoration

Existing Conditions



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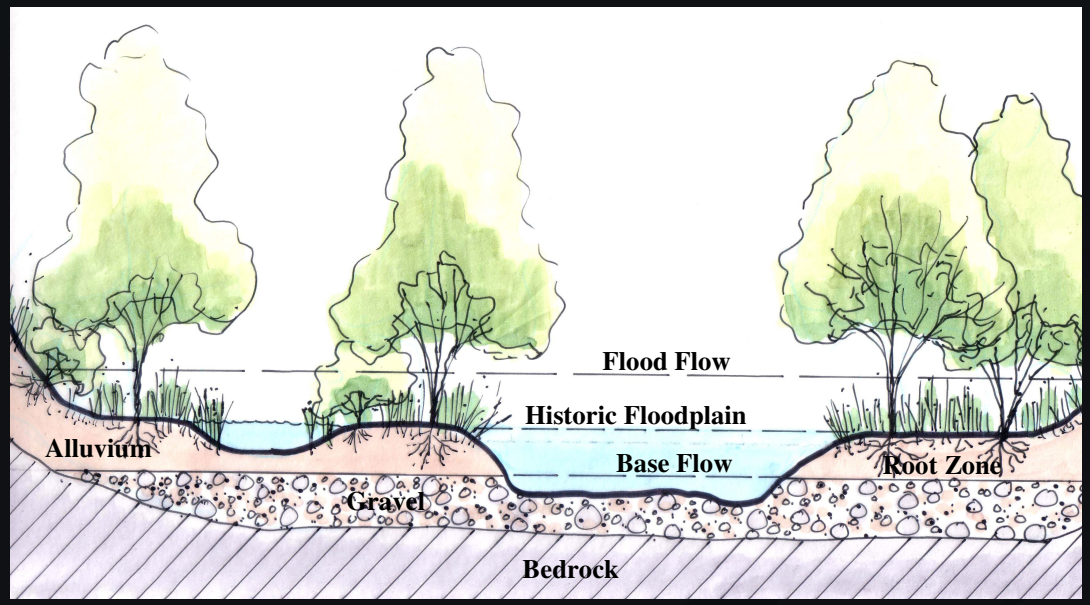

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Real Estate 101

- Riparian land is often readily available in and around Abandoned Mine Land
- Securing land to complete floodplain restoration in more populated areas can be difficult at best
- More Land = Adequate Project Size = Increased Downstream Benefits
- Often AML opportunities are in upstream portions of the watershed

2003 5 19

Benefits of Floodplain Restoration in AMD Watersheds

- Provides treatment option for suspended metals already in the stream network
- Floodplain wetlands enhance water quality
- Reduced sediment loads improve downstream channel stability and aquatic habitat

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